

Incubation and Brooding

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A Thorough and Practical Text
on Incubation and Brooding.
Invaluable to Any Poultry Man
and Essential to a Beginner.

By
Earl B. Hawks, LL. B.

Author of
"Science and Art of Poultry Culture"
and Other Works

Price, 50 Cents
Published by the Author, 1909
Clinton, Wisconsin

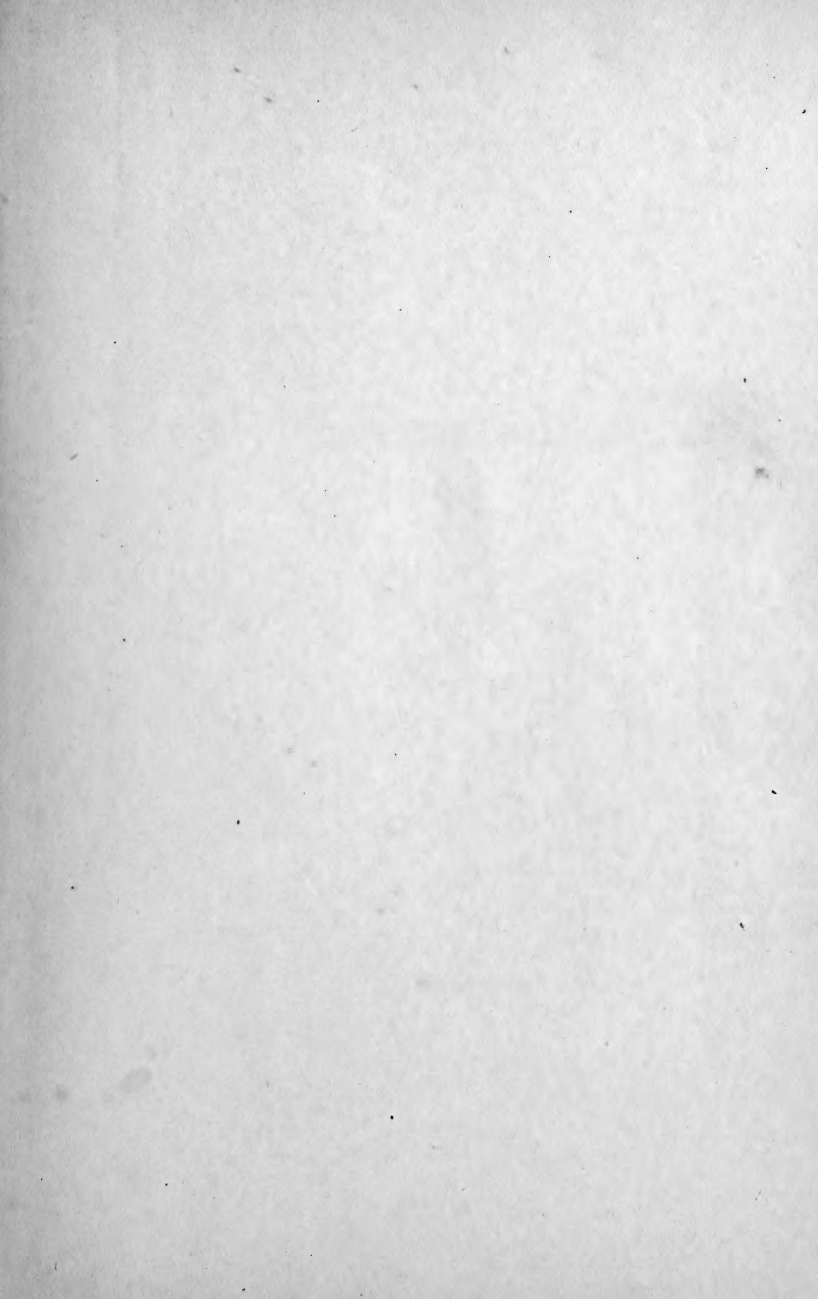


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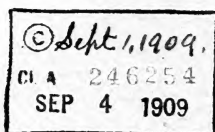
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PREFACE

The knowledge herein contained is given in the five-hundred page work on poultry culture entitled "Science and Art of Poultry Culture," by Earl B. Hawks, LL. B., but the call has been so constant for special information in booklet form that this edition was undertaken to meet this demand. It is the hope of the author that this booklet will give the reader a desire to study more deeply into the science of poultry and thereby become one of the fanciers whose success attest the practicability of raising good poultry.

THE AUTHOR

Clinton, Wisconsin.

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INCUBATION.

GENERAL.

In suggesting a few of the principles of incubation we would desire the reader or student to realize how little is really known about the subject. One investigator believes he has solved aright certain elementary principles while another obtains the same results in an entirely different and seemingly antagonistic method. One believes that the cooling of eggs is a minor matter, another that it is all important. One supplies extra moisture, another does not. Some turn eggs kept before incubation, others deem it useless. One says a better hatch is obtained if the hen is denied free access to oyster shells, while another says nature will not allow the egg-shell to be unduly thick or hard. These and many other elements are the subject of much difference of honest opinion and we believe that science is traveling rapidly toward the correct solution of these many problems. The investigations of the author have forced him to shift his position upon various matters of belief and unless one enters the subject of incubation with a mind open to conviction regardless of former ideas he or she will contribute but little to the advance of poultry science. Again one must realize that no one problem can be solved without taking many others into consideration at the same time; hence, conclusions may be widely variant from the real truth and yet one be honest in reaching his decisions.

However let no person hesitate because there are conflicts of opinion and unsettled or variant methods employed. Success is certain to one if due care and judgment are exercised in following any one of the methods now in being, especially if he will intelligently handle the hens or follow the directions of the manufacturer of the incubator used. That either is no child's task would be well to remember.

The science and art of artificial incubation is of ancient origin. In China and Egypt it was practiced before the Christian era in crude ovens and has become a distinct business zealously and secretly guarded, being handed down from father to son in many cases. In fact, the present chicken of Egypt is the exact prototype of the carvings known to date back two thousand years before the Christian era. The native hen of Egypt has, centuries ago, lost her desire or instinct to sit. The same question has been raised in America and answered by the owners of long bred strains to the effect that the broody habit was being lessened from year to year.

Incubation may be defined as the development of the fertile egg germ from its conception to the exclusion of the chick from its shell. Some may take exceptions to the point at which it begins and place it at a later time, but we prefer to think of it in the above manner, if for no other reason than to suggest earlier consideration and care than is usually given.

Incubation may be either natural or artificial or a combination of both methods. The importance of either is little realized and the latter has supplanted the former in all large establishments. Whatever of disfavor artificial incubation may receive is due mainly to poor machines and ignorant operators. The percentage of

hatches raised to maturity with the same eggs and the same intelligence will not differ by either method. It then resolves itself into other considerations which will be discussed later.

The object of this chapter is to assist in obtaining better results in incubation, and before one sets their hens or obtains or uses a machine let them consider well such information as will enable them to better appreciate the hen and to purchase a better machine as well as to operate it more satisfactorily. Whether the natural or artificial method is employed, if fifty per cent of the original eggs used are incubated and raised to maturity, the operator should feel that he or she has accomplished average results.

EGGS FOR INCUBATING. KIND AND CARE.

The first consideration in choosing eggs for incubation is to select the class, breed and variety of fowl you wish to reproduce. Affecting that choice is the purpose for which you intend the product. Show stock, broilers, capons, eggs for market or other objects would materially influence one's selection of eggs. That being determined a few principles should be kept in mind.

If you desire certain knowledge of the source of your eggs the trapnest is essential. Select eggs that are uniform and normal in size and perfect in shape. When possible use the eggs of one class or breed since they will incubate more evenly. An egg that is small, large, thin-shelled or has lime in excess in the form of warty-like excrescences is very likely to be deficient in other respects. If intended for fancy chicks or flock improvement, evenness of color would also be considered. Eggs have been known to incubate after having been kept for many weeks. Age tends to weaken the germ life.

Two weeks under right conditions is as long as eggs should be kept and the fresher the better. Pullets' eggs do not throw as strong chicks as eggs from yearling hens, nor is the fertility usually as high. To insure a



BUFF COCHIN CHICK.

Courtesy of Dr. J. J. Hare.

strong and fertile germ the parent stock should be prime, sound, healthy and vigorous and their breeding should be correct. Proper feeding is also one of the most important factors as an underfed or overfat hen cannot reproduce satisfactorily.

The care of eggs intended for incubation is also a subject regarding which many differ. We will give general principles upon which the majority of breeders are agreed. See that they are gathered often as the weather will require. They must not be chilled. Keep them in a place where the temperature will stay around fifty-five degrees Fahrenheit and not vary more than ten degrees. Pure air without draughts is essential. Many lay a cloth or paper over them to insure protection. If the eggs have been sent from a distance or subjected to some disturbing motion allow them to rest a day before using. Handle as little as possible. Turn them or not as you desire. Personally we believe turning them occasionally is of some benefit if done gently. Just before placing in the incubator or under a hen many give them an antiseptic bath at a temperature of sixty degrees. This cleanses and disinfects the eggs and many claim much better results. It also lessens the danger of contagion from eggs shipped in from other pens. Many substances are used, chief among them a two per cent carbolic acid solution and a five per cent solution of pure creolin. About seven tablespoonsful of creolin to one gallon of water makes a good wash.

DETERMINING SEX AND FERTILITY BEFORE AND DURING INCUBATION.

Sex before exclusion is a subject which had better be left for further and more accurate investigation but to give a few ideas which have been put forward may result in more interest along this line. Many claim that sex is indicated by the shape of the egg, a roundish egg, more blunt if you please, is the tendency of eggs throwing pullets. Also that the most active embryo in point of development is apt to be a male. Many claim

that the position of the air-cell indicates sex. They claim that the air-cell which has a base parallel to the width of the egg will usually produce a cockerel, while the eggs, the base of the air-cell of which tend to vary widely from such position, will throw a pullet. Others claim fairly good control in mating correctly for such results, keeping in mind the age of the male and female. In many cases where pullets are desired satisfactory results have been attained by using the eggs produced during the first part of the laying period of a hen, while those eggs laid in the later portion tend to throw cockerels. This is applying a known principle in animal breeding. This theory may be entirely thwarted in many instances by exceptional vigor in either male or female.

Known fertility before incubation is claimed as follows: Upon breaking a perfectly fresh egg and putting it under a magnifying glass the infertile egg shows simply a white disk marked with a number of irregular clear spaces. The fertile germ would have an opaque white rim surrounding a fairly transparent center in the middle of which is a lighter spot of variable appearance. This can be of little practical value to the poultry raiser. A practical method is claimed as follows: Place the egg sidewise against the tester, or better yet, with the big end upwards. A strongly fertile germ will cast quite a shadow so that there is a discernable division between the yolk and the albumen with a darker spot or shadow at the germ centre which always floats at the top of the yolk. In the more weakly fertile egg germ this distinction or division will be less marked, while in the egg with an infertile germ the contents will appear clear or milky with practically no distinction between the yolk and the albumen. This method is claimed by many to be

very accurate in the hands of an experienced person. Certain it is that a strong germ does have the tendency toward the above result which is increasingly true as incubation proceeds during the first few days. To what extent that light colored yolks or fertile germs whose development was less at the egg expulsion period would influence to a wrong decision the author is not yet prepared to state. The fertility of eggs during incubation will be treated under the testing of eggs later on in this chapter.

TABLE OF TIME REQUIRED TO INCUBATE EGGS.

Kinds.	Time to incubate depending upon breeds and varieties.
Canary	15 to 18 days
Chicken	20 " 22 "
Duck	28 " 30 "
Goose	28 " 30 "
Guinea	28 "
Pea Fowl	27 to 30 "
Pigeon	17 "
Swan	40 " 45 "
Turkey	28 " 30 "

NATURAL VERSUS ARTIFICIAL INCUBATION.

Where one wishes to raise but a few chicks and is satisfied to raise them during the regular broody season, there is no particular reason for not allowing them to have a natural mother. Again in the hands of busy persons who can give but scant care to a brood the mother hen might give better results. However, to the average poultry raiser, where more than one hundred chicks are to be raised, the incubator will appeal for the following reasons:

Earlier hatching is possible.
Higher markets are made available.
Always ready when eggs are ready.
Hen is kept in the producing yards.
Capacity does not depend upon having hens to set.
Requires less building space than hens.
Good operator will hatch higher percentages.
Less labor required for same capacity.
Absolute immunity from vermin.
No breakage or desertion by hen.
Can have poultry ready for fall shows.
Does not require two breeds to raise non-setting breeds.
Cleaner work to care for same capacity.

NATURAL INCUBATION.

Breeds—Choose a breed and strain of that breed which produces good sitters and good mothers. Do not set a fussy hen which is quarrelsome and easily disturbed. Rather take the quiet, docile hens so that breakage and loss by trampling is reduced to a minimum.

Nesting—Any nest made roomy and hollowed out so that the eggs can neither roll out nor pile up will be serviceable. The materials are not important so long as they are not harsh or disagreeable. Put in the bottom a little earth, or many prefer the nest upon the ground if it be in a dry place. Do not make the nest in a box where the hen does not have sufficient room to turn around without forcing her to be awkward thus endangering the eggs. Old barrels make fairly good nests. When the nest is complete sprinkle into it a little sulphur, powdered tobacco, or insect powder. Lice and chicks are difficult to brood together.

Place—The place is not so important if it be dry and not subject to draughts. It should be apart from other poultry or other broody hens. It should be free from rats and similar prowlers. If several nests

are desired in one room or building, each hen should be fastened into her own nest, or careful watchfulness given, to see that no eggs are left uncovered because of two hens seeking one nest.

Setting the Hen—Having chosen a hen dust her well with insect powder and remove her at night to her new quarters. She will rarely give any trouble about sitting where she is placed. If she is not inclined to be satisfied, shut her in for a few hours until she settles down to business. Give her an egg and if she is alone let her out to feed and water twice a day. If warm arrange water in her nest to save bowel trouble from overdrinking. If she does not show a tendency to return to her nest, gently catch her and replace her on the nest or its edge and allow her to settle. If after two days she still gives trouble, discard her as she will doubtless be easily disturbed and be of little value as a sitter. If she is entirely satisfactory you may now give her the eggs you desire her to hatch. Do not give too many eggs. Fewer will give better results.

Feeding—Place good grain, grit, green food and water where the hen can supply herself with what her nature demands. If she cannot be trusted to leave her nest at will, give her attention at least twice a day in warm weather and see that she has water within reach of her nest.

General Care—Test out the eggs at the same periods as incubator eggs are tested and, unless it is in a very dry climate or a dry season, do not supply moisture. If in a dry place sprinkle the material under the eggs with warm water twice during the last week just as the hen goes back to her nest. The time is important so that evaporation will not cool the eggs unduly. Dust the hen again well about three days before time for her

to hatch her brood. Do not let any opinion interfere with the dusting of the hen with lice powder at the beginning and end of the hatch.

Taking off the Hatch—Prepare a warm dry coop in a place free from draughts and vermin. Gently remove the hen and her brood after you are sure the incubation is complete. Place them into the coop prepared and give them plenty of fresh water but no food for at least two days. See that they cannot wander away from the coop and do not fail to shut them away from all night intruders.

ARTIFICIAL INCUBATION.

The Machine—In buying an incubator do not fail to get the best, as they are far the cheapest, regardless of the relative price one pays. Pay no attention to the fairy tales in the advertising but go over the various makes, point by point, and advise with others using the different machines. What follows may assist in deciding. No machine has brains. Do not expect a machine to be satisfactory unless you follow explicitly the manufacturer's directions in unpacking, setting up and operating. Different makes of machines cannot be operated in the same manner. Their circulatory systems may be vastly different. The details of some machines are valuable time and labor savers. While general principles of all machines are alike yet the application of principles vary.

No success can come to an operator whose habits and attention are irregular and whose memory is uncertain. Do not abuse a machine and blame the maker. A poor machine will hatch well the first season and under good conditions, a good machine will hatch well for many seasons and under more unsettled conditions. Detailed

instructions are with every machine and are usually very plain and simple. Do not purchase too small a machine, as the cost of a larger one is but little more, the cost of operating it is not much higher if any, and it will hatch few or many eggs. It is very hard to dispose of a small machine in the event one wishes to replace it by a larger one. Again do not show each friend how the machine works, if to do so requires touching it. The machine should be level to insure an evenness of temperature in the egg chamber. If you have no spirit level use a pan of water, which for the purpose will do very well.

The Main Objects to Be Attained—In all artificial incubation, as in the natural, certain objects must be kept in mind for success as follows:

1. To keep a uniform temperature of the eggs at the required degrees.
2. To furnish pure air in a correct current.
3. To control evaporation.
4. To prevent the egg contents from remaining in one position.

The Essentials of a Machine—There are many essential parts to a machine as well as many minor parts which are important because they tend to save or hinder by the handiness of their construction. In obtaining an incubator these minor matters should receive some consideration.

The case or body should be made of good substantial material, well joined and well insulated so that it will heat evenly and easily when once warmed through. Its shape is unimportant. The egg chamber and nursery chamber should be roomy.

The regulating device is the brain of the machine and is usually its weakest point in that it will operate

well under normal conditions but fails under certain variations. For example one machine has the smoke flue passing through the machine. In warm weather the heat of the smoke flue plus the heat generated by the chicks at certain stages is more than the machine requires, hence the regulator is valueless after a certain temperature is reached, and without special attention loss would result. Not all makes of machines with smoke flues passing through the machines are thus, yet caution is needed to choose the better ones. A regulator is really made up of several parts including the thermometer which enables the operator to adjust the device. The thermostat, the connection and the damper arm are other parts.

The thermometer should be a good one and well tested. Sometimes it may have been handled roughly in transportation and the mercury separated, in which case it is easily joined by inverting the thermometer and starting the mercury downward into the top end until it fills the stem. Then by a downward swinging motion the main column will be driven against the separate parts and united thereto. If not a complete success repeat the operation. The location of the thermometer varies in different machines. It may hang above, lay on or between the eggs in the egg chamber.

The connecting rod and arm with a damper or other controlling device, are simple in principle, being governed by a thermostat of some kind. Thermostats differ widely in kind and composition. The principle of expansion by heat pervades them all and its mechanical effect on the connection and damper arm lessens or increases the heat units held for use. Some are round, concave, flat or corrugated disks of metal joined and sealed at the outer edges and containing a liquid which is very

volatile at a given temperature. One side of the disk is stationary and the other moves the rod or connection of the damper arm or other device used for the same purpose. The expansion of the liquid within the disk located in the egg chamber, governs the regulator's action. Other thermostats are made of metal only, having the action of a spring when expanded by heat. Many devices are used. The greater the expanding power of the thermostat when attached to a proper regulator mechanism, the more perfectly under control is the temperature of the egg chamber. Therefore it is clearly important to look carefully to this device for proper results. It is the safety valve of the incubator.

The heating parts of an incubator are present to hold the temperature of the egg chamber at an even and desired degree and in an effective manner. This is accomplished in various ways and by various devices. Diffusion and radiation both contend for recognition with the former in the majority. Hot air, hot water, electric and gas machines are on the market. The first two named are the most frequently found and heat the air or water above the flame, passing the heated current into the body of the machine in a manner to warm the egg and nursery chambers. Some machines have single pipes, some double pipes, some flat pan-like heating surfaces as well as other variations of the same principle. Some pass a warm current of fresh air into the egg chamber and nursery while others simply radiate heat and have other means to supply air to those chambers. All have some form of heater about the flame, assuming many forms and many different positions upon the machine. The main consideration is handiness of access to fill and trim the lamp. The smoke flues of some machines pass through the body of the machines, while in some makes the

smoke never enters the machine at any point. The latter plan makes the regulation a little more certain especially in warm weather. The regulator on all machines allows the excess heat to pass away from the machine except on those machines where the regulator controls the amount of heat generated. Practically all machines grant the principle of overhead heating as best.

The advocates of hot air machines claim that the warm fresh air diffused over the eggs at a right current, is the best method since it both supplies the necessary amount of oxygen to the germ life and also carries away by right ventilation the gases thrown off by the developing germ. They also do away with the labor of filling a water pan or tank as well as any danger of a leak. The hot water enthusiast claims a greater economy of fuel, better circulation, and hence more even heat as well as less danger of loss since the water would hold the heat for a longer period in case of accident or neglect. Both methods are obtaining correct results but the majority of operators seem inclined to the hot air machines.

In a heating lamp there is but one object and that is heat. Light is of no importance. The fuel may be anything which forms a gas and is made from many substances, the most common of which is coal oil. Where natural or artificial gas is used a special burner is required and will be furnished by the manufacturer. Where kerosene is used the lamp consists of a bowl or fount, a flue or chimney and a burner. The bowl need be no particular shape but should be large enough to necessitate filling but once every day and should contain an inner division open at the bottom to reduce the danger of spilling by careless handling. The material

may be glass or metal. The latter is less liable to break, but for convenience in filling should contain an extra large filling cap or a device, to show the amount of oil in the bowl or fount. A small air hole should exist in every filling cap for safety.

The chimney or flue is more safe when made of metal than of glass. Glass might break at a time when no attendant was present and cause much loss of time and property. A metal flue should have a mica window to allow the attendant to notice the height of the flame. The flue should be of the size and shape to allow a proper draught of air to supply sufficient oxygen to the flame. If the flue should begin to accumulate soot and grease clean it thoroughly to avoid danger of fire. Some heaters contain the chimney or flue.

The oil burner is the important element in a lamp and the greatest source of danger in a careless operator's hands. The story is ever old of lamp explosions and their results. The wick may be of various substances but no invention has ever displaced the cotton wick. Clean oil, a clean wick, and a clean wick-tube are essential. Do not burn a wick until it is short. Burners are usually of brass and the wick-tube should have a ventilating tube. The perforated base should be kept clean and open to the passage of air. The size of the burner should be governed by the heat required but should be of sufficient capacity to give the required heat without the necessity of using a high flame with its consequent danger. The oil should be of the best with as little odor escaping as possible while burning. The flame is fed by a hydro-carbon gas formed at the base of the flame and being a miniature gas plant the generation should be under perfect control. The wick-tube becoming hot and forming an excess of gas is the real danger and to

avoid this many devices are used to keep it normal. The cool air passing to the flame through the perforations about the tube, metal tongues to dissipate the heat, water jackets about the wick-tube and many other methods are used to avoid this danger.

The methods of regulating the heat supply also vary. Some allow the excess heat to escape into the outer air by means of an automatic damper, while others regulate the height or size of the flame by a mechanical device and by the old-fashioned way of trimming the wick to a point. Some combine two methods.

Lamp boxes are of many kinds and in many cases economize oil, save accident, allow the lamp to be out of the way and make for a more uniform heat because the lamp is not exposed to outside atmospheric changes. The position and holding device of the lamp relative to the ease of attending it, is a very important factor when one must use it for any length of time.

Another important feature of every incubator is the internal arrangement. Is the thermometer where it can be easily read? Is there a roomy egg chamber? Is the nursery tray covered with cloth so the chicks will not slip upon it? Is there ample space between the egg tray when pushed back for the chicks to drop into the nursery and to pass and repass next to the door without crowding and trampling each other? Is the circulatory system good? Are the trays and other parts handy to remove for necessary purposes? Are the trays substantial and well adapted for ease of egg turning? Is the heating device easily removed for cleaning in case of accidental smoking? Many matters have been omitted or lightly touched upon which are really important but enough has been suggested to show the importance of choosing a good machine regardless of price.

Location of Machine—The ideal place to operate an incubator is where pure, fresh air is easily introduced without drafts; where some sunlight can enter, yet where sudden outside temperatures cannot vary a uniform degree of the incubator room. Gases and burned-out air are injurious for egg and beast alike. A half cellar is a good place if ventilation is provided. A cellar, an inner room, a cave or other place can be used if they approach the requirements. Fluctuations of temperature and bad air are the most serious evils to be overcome. If placed in an ordinary cellar the fire insurance policy should be examined and a permit be obtained if not already included in the policy. Ordinary tremblings or jars if not too sudden or severe have not proved injurious as successful incubation has been done adjoining a railway track where heavy traffic passed. If choice were involved a quieter place would be preferred. Heavy electrical storms have been thought to injure hatches at certain delicate stages of development. Avoid hitting or otherwise jarring the egg trays or machine as the germ at certain stages of development is very sensitive. Therefore a roomy place is desirable. A location would also be better if arranged so that the temperature of the room could be kept in the vicinity of 70 degrees.

Starting the Machine—If the machine is new, is set up and in place, cleaning and disinfecting are not necessary. If not then carefully dust and wash the entire interior until it is sweet and clean. Provide new burlap parts if necessary. Next paint the interior of the machine with a ten per cent solution of zenoleum or creolin. If they are not obtainable use a wash of mercuric chloride. Directions for the use of the latter will be given by the druggist as the size and strength of

the tablets or powder will determine the quantity to use. If it be a hot water machine fill the water pan with reasonably hot water. The use of hot water enables the attendant to fill it without danger of its expanding and hence spilling and also allows the machine to warm up more quickly. Next close up the doors and inspect the heating appliances and the regulator. See that the thermometer is still correct by comparing it with a second thermometer in tepid or lukewarm water. Be careful about water being too warm or both instruments will be broken. Place one in its position in the egg chamber and the machine is ready for the lamp which should have a new wick and every part clean. Operate the flame moderately and never leave a machine until you are satisfied the flame is in full combustion. Often upon filling the lamp the full blaze does not begin for several moments after it is lighted, owing to the time required for the oil to climb the wick. If it is cold weather the machine may take more than one day to warm up. When it reaches the desired temperature adjust your regulator and wait a day to see if everything is running well and the temperature remains steady. The eggs may now be placed in the trays. Do not try to place them in rows as more will go in when placed promiscuously. Close up your machine and do not touch the regulator when you find the temperature dropping. It will recover when the eggs get warmed through. If anything herein conflicts with the instructions given with the machine then follow the instructions explicitly. If desired pedigree trays can be employed to keep apart all chicks until they can be marked.

Care of the Lamp—Each day the operator should note that the burner is clean and the wick well trimmed at filling time. Trim the wick, removing the charred

portion by passing a match stem or back of a knife over the wick. Then give just a little attention to the corners that they be rounded or at least free from charred matter. See that no crustations accumulate on the sides of the wick-tube. Always begin with a moderate flame and before leaving, adjust it to avoid smoking or overheating. Use only the best oil as poor oil makes a bad odor. Before taking a lamp from a machine note the height of the flame and when replacing it attempt to turn the flame to the same height as before. If the pipes should become smoky clean them thoroughly at once. Never leave a lamp in a machine while not lighted as the oil will draw up and on the metal and cause it to smoke and smell when next used.

Temperature—To maintain an even and correct temperature requires careful and watchful attention. Note the paragraph on thermometers and see that no errors occur. If you are using a hanging or suspended register a different rule will be followed than when a contact register is used. In the latter be certain to keep the bulb upon a live germ. In the former be sure to place it where the directions indicate. Violent fluctuations or prolonged changes of temperature are usually very injurious especially at the earlier part of incubation. Authorities differ as to the exact degree yet are in accord within certain limits. Beginning the hatch at from 101° to $102\frac{1}{2}^{\circ}$ seems to be the best for the first week, 103° for the second week and until pipping time for the third week. If a contact bulb is used the temperature should be $\frac{1}{2}^{\circ}$ lower. During the end of the second week the temperature will rise, owing to the radiated animal heat from the embryos. Readjust the regulator and again at hatching time, note and meet the conditions arising from the heat generated at pipping time and also

the loss of heat caused by rapid evaporation when many chicks are drying off at the same time. Do not be alarmed if the temperature runs up to 105° during the exclusion period. No harm will result and many claim that it is better. Hatches have been taken off where the chicks before, and at the time of exclusion, were subject to a temperature of 112°. Certain it is that such treatment resulted in harm to the vitality of the chicks. Long drawn out and uneven hatches would indicate uneven temperatures during incubation. When incubating eggs of the Mediterranean breeds or other lighter varieties, a degree lower is often used with good results. If the chicks pant at the time of exclusion do not be alarmed, but they may need better ventilation or a little less heat if the temperature is running high. Unless one knows his business at this point it is better to follow the incubator instructions and not experiment. A high temperature at the beginning of a hatch is more injurious since the tissues are more tender at that period. Also in incubating duck eggs the temperature for the last three weeks should range $\frac{1}{2}^{\circ}$ lower than that of hens' eggs for the second and third weeks.

Turning the Eggs—Operators vary in methods of turning eggs during incubation, and some even go so far as to deny the necessity of such turning, but they are in the small minority. Avoid sudden or quick, jerky motions in handling eggs. Begin turning the eggs about the third day and cease turning the evening of the eighteenth day for hens' eggs, or if duck eggs omit turning after the twenty-fourth day. Never touch an egg with soiled hands nor after filling the lamps unless soap and water have been liberally used. Some turn the eggs once a day but the majority of operators turn them twice a day as nearly twelve hours apart as possible. Be regular in this work.

It is not necessary to turn the eggs over just half way in fact it is much better that they be turned differently each time. See that no eggs are left standing on end and do not try to keep the eggs in rows in the tray. Many patent devices are used to turn eggs, but none are as satisfactory as the hand method, especially with a slightly sloping tray. This is accomplished by removing to the ends the two middle rows of eggs next to the



SINGLE COMB RHODE ISLAND RED.
Courtesy of Lester Tompkins.

partition and rolling the remaining eggs down toward the tray center with the flat of the hand. Many believe that the turning should be done just at the end of the cooling period and just before the trays are replaced. This method allows the contraction to take place first after which comes the movement of the embryo. In the double tray machines turn the trays end for end at night and from side to side in the morning after the first

day. This evens up the temperature of the eggs regardless of where they were placed originally. In single tray machines end for end once a day is sufficient. Many operators in order to assist their memory write the word "night" on one end of each tray and thus see that the turning brings this word outward each evening. When replacing the eggs do not touch the regulator as the heat will soon bring the temperature to normal again.

Cooling the Eggs—The importance of cooling has been largely underestimated in artificial incubation. A few manufacturers are emphasizing the importance of this fact. The relation of cooling to evaporation of moisture is not yet clearly defined but is an interesting study. The aims and amount of cooling are difficult to clearly explain and much experimenting along this line is in progress. Certain it is that during the period of incubation a definite amount of heat is required to bring out a perfect or ripened chick, and that heat should be spread over the whole of the natural period as well as be balanced by a right amount of cooling. Proper cooling lends vitality to the embryo and by a gradual process accustoms the developing chick to the new world it is about to enter. The question of ventilation and oxygen supply enters here to a slight extent but under right conditions is of little consequence.

The length of time cooling should take can be fixed by no exact rule. Experience will tell an operator much which cannot be stated. The "feel" tells its own story and takes into consideration the temperature of the room, the stage of incubation and the previous temperature of the incubator. The best one can do is to give approximate temperatures and let judgment act as a supplement.

DAILY COOLING TABLE.

Room Temperature	Operating Temperature	Cooling Time	
		First Week	Second Week and Thereafter
30 to 40	103 Degrees	3 to 5 min.	5 to 10 min.
40 to 50	103 Degrees	5 to 10 min.	10 to 15 min.
50 to 60	102½ Degrees	10 to 15 min.	15 to 20 min.
60 to 70	102½ Degrees	15 to 20 min.	20 to 25 min.
70 and above	102 Degrees	20 to 25 min.	25 to 60 min.

The above will be the latitude usually given, but one must again follow instructions, as some machines have circulatory systems which do not require so much cooling of the eggs as do others. When using the suspended thermometer the above rule holds, while with a contact thermometer one degree lower within the machine is the rule. Unless the incubator cellar or room is free from draughts it is better to cool by simply leaving the incubator door open. The time spent in turning may be sufficient for the first few days and should be determined so that overcooling may not result. In test days do not cool. Begin to cool upon the second day and discontinue the evening of the eighteenth day except duck eggs, which discontinue upon the evening of the twenty-fourth day.

Testing Out Eggs.

The purpose of testing out eggs is to save infertile ones for commercial gain, make more room for fertile eggs, discard those whose germs have died, and more than all to better understand the many problems leading to stronger egg germs and better incubation. The lessons of testing and the deductions therefrom cannot be satisfactorily given in the form of photographs or cuts. Real experience in the testing room is the surest and most

rapid method of education in egg testing. Do not be afraid of using a few dozen eggs in this work.

The best time to test out eggs is in the late evening, thus doing away with the necessity of a special dark room. A tester is furnished with every machine and if not any tinsmith can make one from cuts shown in every catalogue of incubators. For daylight or night candling a pasteboard rolled into the form of a horn is sufficient. Place the egg into the small end and hold up to the sun or a lamp. In handling eggs do not use quick, violent motions as they injure the delicate structure of the embryo. Allow no draught in the testing room.

The temperature of the room should be about seventy degrees, but if it is not convenient to gain this temperature, test out at each cooling period until the testing is completed. Test out dark shelled eggs about the seventh day, light ones about the fourth day and repeat the test at any time before the eighteenth day. Beginners should test more often and mark all doubtful eggs replacing them for future study. Be careful to keep a contact thermometer upon a live germ. Duck eggs can be tested as easily as the egg of the hen and about as early.

In placing an incubated egg to the light it will show perfectly clear if infertile. If fertile a small dark spot will appear and a bulky shadow will also darken the interior. If well started the germ will have spider-like threads or blood lines radiating from it. If not clearly seen turn the egg slowly or reverse ends. Do not keep the egg held to the heat and light but an instant and use quiet motions in handling it. If a weak germ has started and died a dark red circle or circular streak will appear, or perhaps a black spotted ap-

pearance may be present if the egg is decaying. The second test should show a dark, well filled shell. Many will state that the first test ought to show the air cell to be about the size of a quarter of a dollar and at the second test the size of a half-dollar. Others will advise that the air cell during incubation should occupy from one-third to one-fifth of the shell's space. If it varies either way there is too much or too little moisture. The beginner had better take all this advice but not use it, as there is no set rule which will apply to all kinds of eggs or under all conditions. In dry countries and in moist climates this will bear study, but in medium climates it is of much less consequence.

Moisture and Ventilation—The questions of temperature, moisture, ventilation and cooling have much of inter-dependence. Circulation and humidity are really but ventilation and moisture in different language. About these words there centers much of unknown interest to the student of poultry science, but in touching these questions herein only practical and elementary statements will be made. While temperature is extremely important, so also is moisture and ventilation. The real object desired is to obtain proper ventilation in the egg chamber without an excessive current of air. Here also hinges the moisture question as it is the air current or circulation which robs the egg of its moisture if it be excessive. Some machines have special ventilators or air passages while others depend on passing pure air through the machine. Some evaporation is necessary, so the real problem is to obtain temperature, circulation, ventilation and evaporation combined to the right degree. In order to handle this problem in any intelligent manner one must consider the season, air humidity, make of machine, room tempera-

ture, room ventilation, and dozens of other minor matters which have a bearing. Impure air is as fatal to a strong hatch as any other one cause.

A query arises as to how one is to know when he is handling the moisture question aright. Given pure air by diffusion or otherwise in the egg chamber and a scale which will weigh to the ounce, the evaporation may be governed to a very practical degree as this subject is now understood. By weighing the eggs when they enter the machine upon a dry tray and weighing them at any later period the actual loss is readily obtained. If too dry moisture could be added or the circulation checked. By this means one could study the relative space occupied by the air cell until he became proficient and could judge well enough for all practical purposes of the real condition and progress of the germ development. Moisture registers are now available.

The evaporation of hen's eggs for the first nineteen days of incubation should be about sixteen per cent of the total weight at the beginning of the hatch. Duck eggs would require that about the twenty-fifth day. It also must be understood that evaporation should be slight at the beginning of a hatch and gradually increase. Many prefer that the first week should only have three per cent of the total of sixteen and then increase to about the fifteenth day, after which a slight decrease should result to the nineteenth day. Duck eggs really require a little more moisture and ventilation than do hens' eggs, yet cooling will often be neglected for moisture to the detriment of the hatch.

The presence of too much moisture tends to not allow the chick or duckling enough room in the shell to pip easily as well as weakens the constitution of the bird. Too little moisture renders them unable to get

out of the shell after pipping in part and if excluded often becomes a cripple. In supplying moisture many methods are used other than lessening the air current. Many put the moisture into the machines while others keep water in or sprinkle the room. Except in dry climates a properly ventilated machine will need no water within it and rarely needs it sitting in the room, although the latter method can do no harm and may often be of some real service. If the door of the machine shows a sweaty condition during exclusion or before do not let it trouble one as it will often appear under normal conditions. Do not open the door during the exclusion period, as more invisible damage will usually result than any good accomplished. If the birds pant they may need just a little better ventilation or the temperature may be running high. A machine with a fair sized nursery chamber is most desirable as the oxygen will be used up less rapidly.

Hatching Time—Cease turning and cooling the evening of the eighteenth day. Push back the egg trays to allow ample room in the nursery front. Use any pedigree tray, thermostat guard or other appliance required and do not again open the incubator door until after exclusion. A chick is not worth helping out of the shell when the good of the entire hatch is considered. Because one or several do not die when the door is opened leads many to believe no harm comes of such act, the results of which are always in the future. The chicks ought to begin pipping on the twentieth day and be fully excluded upon the twenty-first day if all has been well before and during incubation. Hold the temperature steady until pipping begins when it may fluctuate as before described. If the chicks are excluded and dry and seem to need air fasten open the

incubator door just a trifle or ventilate more freely. Allow the temperature to run down to 100° and if the room is 70° or above quickly take the chicks out of the incubator, place them into a lined basket, cover them over and take them to a brooder properly prepared for their reception. Some prefer to leave the wee birds in the incubator for two days. With correct care it is immaterial when they are transferred if they are all excluded and well dried off. Do not neglect to clean the machine at once after each hatch and when another hatch is to be put on begin as though the machine were not ready, which insures better results. One cannot be too particular in the care of a machine.

WHAT CAUSES THE DEVELOPING GERM TO DIE IN THE SHELL?

This question is constantly being asked and following are given some of the causes in brief form:

Parent stock weak reproducers by inheritance.

Parent stock imature or diseased.

Parent stock ill-fed, ill-bred, or ill-housed.

Eggs saved too long.

Eggs kept in wrong temperature before incubation.

Eggs chilled before collecting.

Eggs saved out of natural season.

Forced feeding for eggs.

Careless choosing of eggs.

Handling eggs with oily hands.

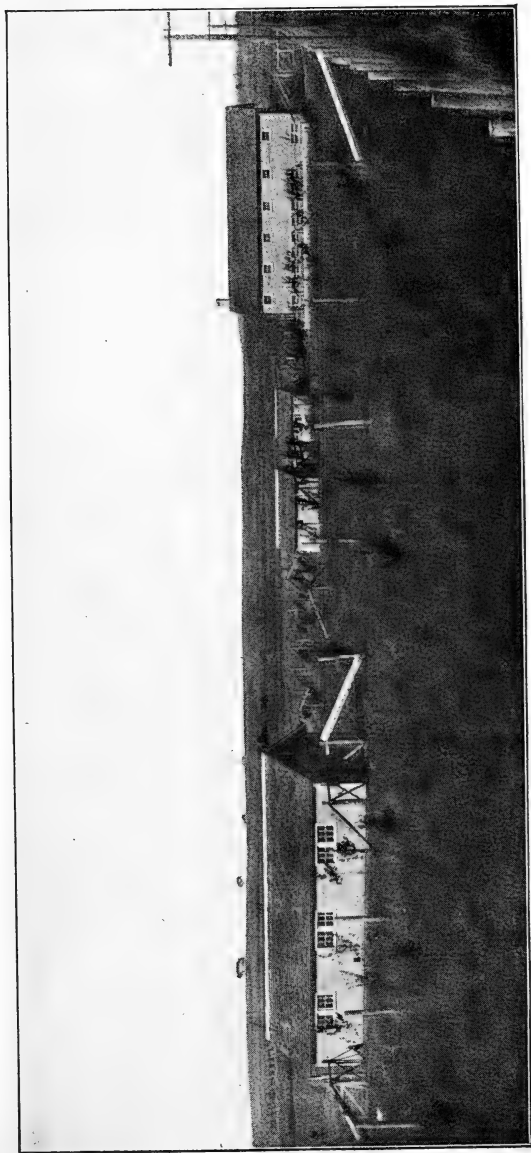
Impure air during incubation.

Moisture improperly governed.

Heat improperly supplied.

Improper cooling.

Drafts present at turning, testing or cooling time.



BIRDSEYE VIEW SHOWING NEW ORCHARD, BROODER HOUSE, BREEDING HOUSES
AND UTILITY HOUSE.

Courtesy of Peerless Poultry Plant (Inc.).

PEERLESS POULTRY PLANT

Breeders of Line Bred Barred Rocks.

We are located at Clinton, Rock County, Wisconsin, in a very rich farming country. Our plant is in the edge of the village, only six blocks from the depot which belongs jointly to the Chicago and Northwestern Railroad, main line, and the Chicago, Milwaukee and St. Paul Railroad. Every train on both roads accommodates passengers for Clinton. We have 25 mails each day. The Wells, Fargo and Company and American Express Company each have an office here. With such advantages we have an ideal location for our poultry plant, which is devoted exclusively to Barred Plymouth Rocks. Our plant is under the personal supervision of the poultry expert and author, Earl B. Hawks, whose works and writings are known throughout America and Europe. Nowhere can we find more healthy or more vigorous breeding stock than in our yards. All our stock is bred by us and reared on range. In quality our "Peerless" Barred Rocks have no superiors, and anyone desiring birds for breeding or exhibition purposes can do no better than to call on us or write for prices. During the breeding season we can furnish stock or eggs for hatching purposes from breeding pens that are classic in shape and color as well as the best utility fowls on earth. Our hobby is to satisfy customers by giving high quality at right prices. All visitors welcome.

PEERLESS POULTRY PLANT (INC.)
Clinton, Wis.

BROODING.

The subject of brooding is of equal importance with that of incubation. It is an old saying that "a chicken well hatched is half brooded."

Brooding is a term used to indicate the developing of the young of fowls from their incubation to their maturity. It is a comprehensive term and includes every environment which makes for better or for worse in the younger life of a fowl. In treating this subject the reader's knowledge of brooder houses will be assumed as it properly comes under poultry house construction. That successful brooding is confined to a few principles carefully applied does not seem to lessen the unnecessary loss so prevalent in the poultry business, although a gratifying tendency toward better results is in evidence throughout the entire country.

Natural and Artificial Brooding—Brooding may properly be divided into natural and artificial brooding; the former by the female fowl, the latter by many methods which really are one with the former in principle and practice. In choosing which method is the better one must consider each individual case since the number of young to be reared, the experience of the operator, the room available, the equipment obtainable, the question of labor assistance, and many other problems are to be weighed and considered carefully. Where but few are to be reared it may be more economical to brood by the

natural method. The main claim for the natural mother is in the care and teaching she gives her young at the approach of a storm or other danger, the hovering when the young express a desire for warmth and the teaching of the proper food her young should eat. The artificial brooding advocates follow with the argument that the brooder is always ready and willing to hover, does not drag the young in the dew and rain, lessens the danger of lice and mites, gives the young its choice of degrees of heat, makes the young more self reliant and domesticated and materially lessens the care expense when any numbers are considered.

Mortality in the Brooding Period and Causes—The loss of young stock during the brooding period should not exceed over five per cent of the total hatch under normal conditions. By normal condition is meant the exercise of knowledge in a careful and practical way. The science and the art of brooding should be combined to a reasonable extent and good results are bound to come.

In showing some of the causes of chick mortality we will divide them into two main classes, which relative to brooding will be designated as primary and secondary causes. The former are controllable before brooding, the latter during brooding. The one is beyond the brooding operator, the other entirely within his control. The loss which can be blamed to the one or the other cause is not always easy of recognition. No brooding can make a success of a chick not well incubated.

Primary Causes—

- Unsound parentage from breeding or age.
- Unsound parentage from care and feeding.
- Eggs poorly selected and poorly kept.
- Improper incubation for any reason.

Secondary Causes—

Enemies like hawks, crows, rats, foxes, weasels, etc.
Too much heat or cold and draughts.
Ragged brooder curtains and carelessness in handling.
Stealing, sudden storms, wet grass, etc.
Open holes, open water barrels, watering receptacles, etc.
Overcrowding and consequent trampling.
Lack of fresh air and pure drinking water.
Mash feeding when great care is not exercised.
Improper feeding of grass, grains, meat and too little grit.
Lice, mites and other parasites and diseases.
Allowing larger sizes to run with smaller sizes.

Many other causes may be enumerated, but enough have been cited to impress upon the operator that to begin with good, strong, vigorous chicks is one half of the brooding, and that the secondary causes are well within his or her power to overcome. A primary cause is often present with a secondary one and is a favorite excuse with some operators to shift the blame when it really is brooding neglect that is at the base of all the trouble encountered.

NATURAL BROODING.

Natural brooding in most cases follows the incubating period of the mother. In many cases a few hens are set at the same time as an incubator and all the incubator chicks are divided among the hens, giving to each from twelve to twenty-five according to her size and disposition. As a rule fifteen should be the limit to any one hen. Many times when the incubator is about to hatch, a few quiet sitting hens are procured and given an egg or two apiece from the incubator and allowed to hatch them out. Nearly all the hens will adopt the baby chicks and they are then given those from the incubator. Capons have been thus used, being motherly in their disposition. One should

never use a sitting hen with scabby legs or other diseases. A hen which has not incubated her own eggs for the natural period rarely ever stays with her chicks as long as does the hen having fully incubated her flock.

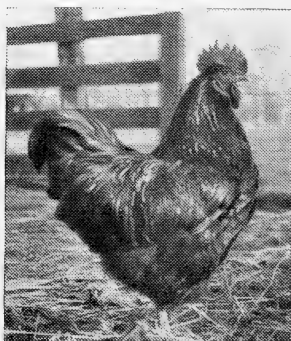
Place—It is essential that the hen be restrained either by the limits of the coop or by a yard small enough so that the chicks may not suffer from the wet grass, rains, and too much exercise. Have the coop dry, warm, well ventilated, without draughts, ratproof, and easily cleaned. Keep it on fresh ground and well cleaned at all times.

Feed and Water—The same care should be given the chicks as given in the artificial brooding. The brooding hen should be given grain and water and such other feed as will keep her in condition for her duties. Perhaps one of the strongest reasons for failure in natural brooding lies in too little attention being given to the manner of feeding and the amount of food given. It is quite essential that the feed be of the right amount and kind and still more important that it be where the mother bird is not able to deprive the chicks of their rightful share. Again a foul place to feed arising either from droppings or a soured feeding place will bring disease and its consequent loss. If one cannot use a separate compartment in which to feed the chicks it is best to have a pail of whole grain from which to feed the adult fowls so that the brood may have a better chance to obtain the food intended for them alone. Watch that the drinking founts do not become unfit for use.

Development—As to general care and treatment everything which applies to the artificial brooding will also apply to the naturally brooded chick. The separation of the sexes, the weaning, the feeding to attain a certain object are the same in either case.

ARTIFICIAL BROODING.

Artificial brooding has long been practiced even before artificial incubation came into existence. Some of the old fashioned ways were quite as successful if not as convenient as the later methods. Artificial brooding has become quite necessary to breeders who raise poultry in large numbers and at a time of year when hens are not obtainable. For the commercial broiler and duck raisers they are indispensable. In fact but few poultry farms grow the young stock in any other way than by artificial means. It is a delightful sight to see a brooder full of happy



SINGLE COMB BLACK ORPINGTON.

Courtesy of Foxhurst Farm.

and contented chicks lying stretched out upon the floor of the hover. On the other hand no more pitiable sight could exist for the lover of poultry than to see a listless, uneasy brood, going through the varying periods of chilling, sweating, and struggling for existence due to an ignorant, careless operator, especially when one knows that it has an uneven battle for life. Give a healthy chick half a chance for life and it will win, but to confine it in a death trap in which no form of animal life could long survive and expect it to develop is to be both ignorant and cruel.

Essentials of a Cold Brooder—Operators are claiming success in the use of a brooder which is supplied with no artificial heat even in zero weather. The aim is to retain the body heat of the chick for its own benefit by means of a warm hover which is insulated against changes of temperature from without and at the same time conserving



A VETERAN BARRED ROCK.

the body heat within. If entirely practical when rightly handled it would have many advantages. We merely give the principle as above stated pending further experiments, therefore we decline to doubt the sincerity of either its advocates or its critics. All other elements of brooding would be in common with warmed hovers as found below.

Essentials of a Warm Brooder—In purchasing a brooder one should correctly understand what constitutes its essentials and to do this is to keep well in mind the object to be attained. The construction of the various parts of the brooder should allow certain results to be easily and certainly attained.

There should be a steady flow of properly warmed, fresh air supplied by overhead diffusion so located and protected that the chick can easily find the source of warmth as well as be able to get away from it when uncomfortable. To secure this the lamp, heater and piping should be examined and if inadequate should be



ROSE COMB RHODE ISLAND RED.

Courtesy of Lester Tompkins.

rejected. It is not important whether it be a hot water or hot air system but if the latter the supply of fresh air must be insisted upon. An accurate thermometer is very essential to a beginner, although the older operators watch their birds more than the reading of the thermometer. A regulator is also used by some. There should also be provided plenty of exercise and a choice of temperature secured by a hover, day or exercising room, limited run and yard.

Ventilation should be carefully watched as pure, whole-

some air is one of the main factors in all animal life. In the warm air brooders this problem is half solved but in every brooder other provision should be made to allow the exhausted air an opportunity to escape.

Dryness, a reasonable amount of sunlight, roominess, an adequate place to feed and water, a movable device to keep the wee chicks within bounds and the entire brooder so built and arranged that it is easily cleaned, all these are well worth careful consideration. While a brooder is simple yet that simplicity is most exacting.

Kinds of Brooders—Putting aside the different modes of supply heat among which are hot air, hot water and electricity, there are several styles of brooders in operation, chief among which are indoor, outdoor, and plant brooders. The two former are usually individual and movable while the latter one is stationary and is usually spoken of as a brooder house. The brooder house is often a combination house and utilizes a portion of the floor for steam pipe or air heating over which is a hover arrangement to accommodate the chicks or other young fowls. These buildings often have more than one brooder floor or shelf, thus increasing the capacity by as many times as there are floors. This also lessens the care taking to quite an appreciable extent.

It is the main purpose here to divide brooders into two classes only, indoor and outdoor machines. By indoor brooders are meant those machines which are so built that some extra shelter from wind and storm must be provided. It is usual to place them within a brooder house, protected shed or any other place where conditions will be favorable and the heat maintained to the right degree. Very few of them will maintain a correct temperature unless the chill be taken out of the room wherein they are located. The outdoor brooders are often recommended

for both outdoor and indoor work, since it matters little what the temperature is without. Properly constructed they should give very little trouble even under adverse conditions.

The question of a heating system in a building as compared with the individual brooder is largely one pertaining to the number of fowls to be kept and the operator's experience. Where the stock to be raised will only number a few hundred it doubtless is economy to use individual brooders, since it costs as much to warm up the system for a few fowls as for the full capacity. However where many are to be raised the system is essential to economy. In the individual brooder a mistake or accident affects only the one brood while a similar trouble in the system affects the entire output.

Setting Up a Brooder—If the machine is purchased of a manufacturer do not assume to be able to set it up without carefully reading over the printed instructions. Many errors and faultfindings are due to this one cause and no matter how familiar one may be with brooders the instructions of the manufacturer may be able to save time and needless criticism.

Capacity of a Brooder—Apparently contradicting the thought expressed in the preceding paragraph we now caution the operator against one of the greatest evils of artificial brooding, that of overcrowding. When any manufacturer claims that any one compartment hover will accommodate more than fifty chicks at one brooding it is time that the individual should exercise some sound judgment on his own account and save consequent suffering and loss among the brood. The claim of the average manufacturer should be reduced by one-half. Each justifies himself in his false claim upon the ground that he is rating his machine according to the standard

set by other manufacturers. In no way is it justifiable especially in the light of the fearful chick loss caused by the consequent overcrowding. Fifty chicks in one hover is the outside limit that should be allowed and fewer would give better results. A liberal floor space under the hover, a spacious nursery or exercising room which is cooler than the hover, and later a run are all very important to successful poultry brooding.

Locating a Brooder—Indoor brooders during cold weather should be placed in a room or building with some provision for heating it to about seventy degrees. If it is late spring or summer any place protected from the sun, storm and wind will be sufficient. Placed in brooder house runs the machines are easily cared for and the chicks have their liberty even during stormy days. A colony house is an ideal place for a brooder if the floor space be large enough and the right temperature can be maintained.

Outdoor brooders may be used in any location desired although if one chooses the best available place the chicks have that much more in their favor. Avoid extremes of sun and wind. Keep each size of chickens or ducklings by themselves. Give every advantage to natural shelter in location, thereby saving fuel and possible danger of lamps becoming extinguished. Be careful to choose level ground or use artificial means for that purpose.

Preparing the Brooder—When the brooder has been chosen, set up and located, it should then be made ready for the brood at least a day in advance of the time needed for use. Start the lamp, taking every precaution used in the lamp and heater of an incubator. While the temperature is rising to the desired point scatter dry fresh sand or soil upon the floor

of the hover and day room, covering it with a little fine cut clover or chaff free from barbs or thistles. This will allow dryness, exercise and cleanliness. Many use gravel instead of sand while some use grit in the sand. Many prefer to let the chick wait for its grit until time for its first feeding and then use it somewhat sparingly. Their reason is that many brooder chicks do not discriminate enough in their feeding and overload on bright, attractive grit. When the temperature has risen to a proper point and the hatch is ready to take off place fresh water into a proper receptacle and the machine is ready for its downy dwellers.

Temperature—There should be three or four different temperatures for each machine and its environment. The hover, the day or exercising room, the limited run and the yard should each have its own degree of temperature. The last two named in mild weather will be of like degree. This variation allows the young to choose their own temperature fitted to secure comfort according to its size, weather and brooder conditions.

The hover should not be a place where a healthy robust chick or duckling would wish to stay for more than a short time during the day. It should range warm enough so that a short day stay would suffice, and at night to allow of a well spread out brood. What this temperature ought to be is very hard to define, since like in human beings any two days might be widely variant. A damp, bleak day requires a higher temperature to maintain a certain degree of vitality than would a bright sunny day. Again during the winter months a different degree would be desired than would be necessary in warm weather. In the winter a dash from a cold run into the hover should meet with a quick warmth while on a mild day a lesser degree would warm

up the young quite as quickly. These are matters of the judgment. This also explains why some authors advise a hover temperature of 90° while some advise as high as 105°. The happy medium for a beginner is from 95° to 100° until one can learn from observation the real needs of the brood.

Again as the brood grows older the need for artificial warmth grows less and to obtain robust birds the heat must accordingly be reduced week by week until weaning time when it is entirely taken away and if deemed necessary a dummy hover used to keep the natural body heat confined to some extent. The average heat reduction varies with different operators from 2° to 5° per week depending upon the weather and the season.

It is better to carry too high a temperature than to allow the brood to huddle and crowd and then sweat. Too high a degree devitalizes, although better too warm than too cold. When they are comfortable they will be well spread out and peeping out of their hover. When they wander about, are listless, crowd and are complaining, attention should at once be given. Also remember that the flame or other source of heat should be ample to keep up the temperature in the early morning when the outside conditions are most unfavorable, the vitality of the brood is lowest and the oil and wick at least efficiency. Control the temperature from the flame and ventilators.

Teaching and Caring for the Brood—In handling a newly hatched brood intelligently one must understand that they come into the world motherless, with certain instincts more or less developed and at the mercy of the caretaker. They know nothing of the ways of their new world and must be taught. That they are apt pupils

is needless to say. They have an instinct to move slightly upward when in motion, an instinct to eat and drink, an instinct for warmth, and an instinct or early habit formed to recur to the place where these comforts of life were once obtained. Therefore to take advantage of the last named tendency will save one much waste of time trying to change their early habits because they were not given somewhat permanent conditions the first few days.

The first named instinct is often taken advantage of by placing the hover higher than the day room, also allowing an advantage of temperature. The hover teaching is best attained by leaving the brood in the incubator until they are about two days old so that they may be placed into the brooder toward evening in time to partake of a light supper, fresh water and then at once be placed under the hover for their first sleep. Having been warm and comfortable during the night the tendency the next day is to return to the hover when chilly, and by a little close attention for the next two or three days they will care for themselves readily. If they have been neglected during that period and should have huddled in a sunny spot when chilly the recurrent tendency will exist for days. To teach them easily and save time the operator should have a small device covered with fine screening which will fit the hover so that when set in any position desired it will not allow the brood to get more than a short distance from the hover, or if desired quite confine them to the hover. By placing this in position the first evening one can rest assured that none of the brood will wander away and get chilled during the night and at the same time no air will be shut off. By giving more room about the hover each night the teaching is completed with very little effort. The

same device is used during the day to place the brood entirely under the hover for a very short time until they have learned that the hover is the source of warmth. By gradually limiting their entrance to the day room, to the run and to the yard, only a short time will elapse until they are independent except in the case of sudden storms, which is another new object lesson. Be on hand when it begins to sprinkle and drive the little ones into shelter at once. After a time or two they will at once seek shelter upon the approach of a storm. This is especially important in the case of outdoor brooders. The attendant whose personal comfort is placed above that of the brood will allow plenty of loss during severe storms. They easily drown while small and cold rain will also chill them.

Many operators who raise but a few often assist the chick or duckling by dipping the beak into the water and tapping the floor to show them the food. We believe both a useless practice and also impractical with large broods. Instinct will suffice for nearly all and the more backward ones have the example of the more forward ones. The teaching of the brood to come by call is accomplished by the voice, a whistle, tapping on a pail and numerous other devices.

Watch every discomfort and especially any overcrowding and correct them. Always shut in the brood at night to protect them against all kinds of enemies. Protect them against lice and mites, for even brooder chicks will sometimes become infested by means of the English sparrow.

The care of the lamps and heating system is the same as with the incubator except that the outdoor brooders should receive closer attention during rough weather,

and during hard storms the attendant should inspect them more often.

The cleaning of the brooders should be regular. Twice during the first week, three times during the second and third weeks, and daily thereafter is sufficient. Air out the brooders daily if the weather and age of the brood allow. Sunlight is the deadliest enemy of poultry diseases known. Keep the brooder sweet and sanitary. If possible remove the hover for cleaning and airing. Do not throw the refuse upon the ground as the ground soon becomes filthy and unsanitary. Have a place for all refuse and at stated times place it upon the proper fields or sell it. Whenever a brooder becomes empty always disinfect it with any good disinfectant and air it out well before using again. Diseases such as white diarrhea will infect a coop or brooder for many seasons unless precaution is exercised.

Watch the brood for the appearance of any disease. Bowel trouble is the one most likely to attack the brood and may result from many causes, principal among which are weak parentage, improper incubation, wrong feeding or careless brooding. Make a study of any good work on poultry diseases and their remedies in order to become more capable of detecting any approaching trouble.

FEEDING AND EXERCISE.

Exercise is to the young of fowls just what it is to all warm-blooded life, an absolute necessity. Keep the brood busy and strength and vigor result. This is accomplished by feeding in litter in the day chamber and run. At first place it only about a half inch deep increasing the depth each week. Some breeders will place an alternate layer of litter and feed to the depth of several inches and feed no more until it has been well gleaned. This method saves labor but is much discouraging to the

weaker members of the brood. What kind of litter to use is a pertinent query and inch-cut clover best answers it because of the food and medicinal value of the leaves. Any litter will do which does not afford too much irritating dust or barbs and is fine enough for ready movement by the brood. Litter placed upon dry soil or sand affords more exercise since the seed is less available by small effort.

Feeding is a subject regarding which there are a great variety of opinions, yet when analyzed are all based upon common principles as will be seen on a study of our analysis of foods in "Foods and Feeding."

The young of any common fowl should not be given food at once upon exclusion, since just before hatching the yellow or yolk of the egg is absorbed by the developed embryo and retained by it for use as a food for the first few days of its free existence. To introduce other food into its system before this yolk has time to absorb is to do for the newly hatched fowl what severe biliousness does in the human family. By giving the system time to digest this food provided by nature the start in life will be vigorous and responsive.

The first food should be given at the end of the second or third day and should be doled out sparingly. Water, fresh and pure, should be given freely from the first and kept constantly within their reach. Charcoal and cut clover should also be a daily supply. Grit of such size as can be easily swallowed should be supplied early. Some claim they should have all they can be induced to eat before any food is given. Others claim such a course leads to disaster because the wee birds do not know when to stop eating the attractive looking objects. We believe in a liberal allowance in the food for a few days, then placed before them in a hopper.

Besides water, grit, clover, charcoal and shell a correctly balanced ration for complete and normal development is necessary. Note under "Foods and Feeding" a discussion of balanced rations. The controversy over dry and wet mashes is unnecessary as either method is correct if properly handled. In wet mash feeding it is quite essential that only enough be given to satisfy the appetite, thus insuring a clean place to feed again. All dishes, pails and feed troughs should be well cleaned each day. It is the decomposing matter in the cracks and crevices that harbor bacteria so deadly when put at work in the digestive tract of a little bird. In dry mash feeding this danger does not seem to exist to the same extent.

WEANING.

Weaning in connection with brooding by either natural or artificial means is the gradual process of reducing the supply of exterior heat to the point of total extinction.

Under the mother the brood gradually outgrows its quarters and only by crowding one another away can a temporary shelter under the mother wing be enjoyed. This process alone tends to wean the brood until a point is reached where the mother refuses longer to be thus abused and returns to her former childless world. If the natural mother hurries this weaning she can still be made to hover them at night by confining her in the coop in which her brood stays, and if she will not allow them to enter such coop then she must be discarded and a cloth hover afforded until such time as the brood can shift for itself at night.

In the artificial brooding it is a question of heat reduction week by week, as explained in "Temperature," until they can do without any artificial supply unless

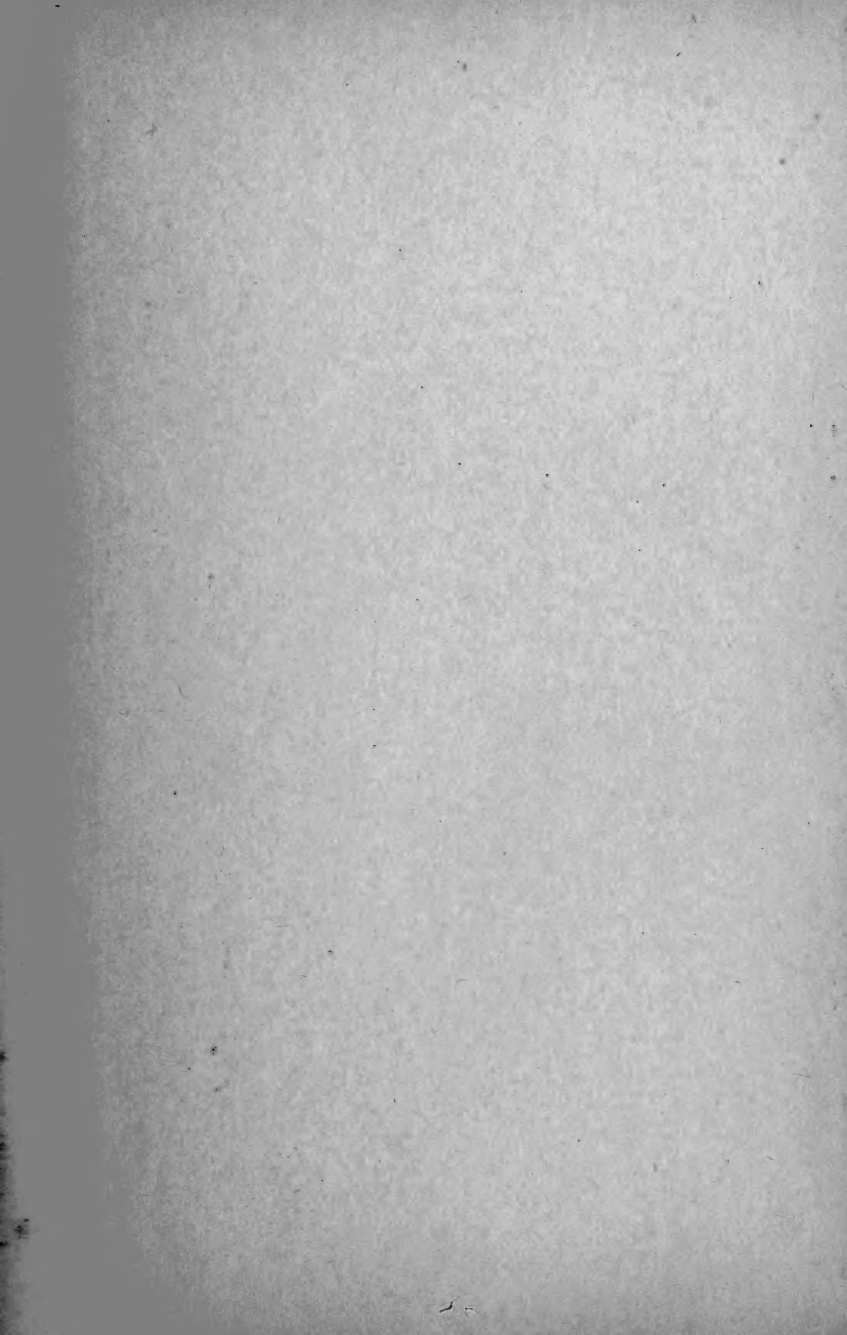
a cloth hover be furnished to retain their own body heat.

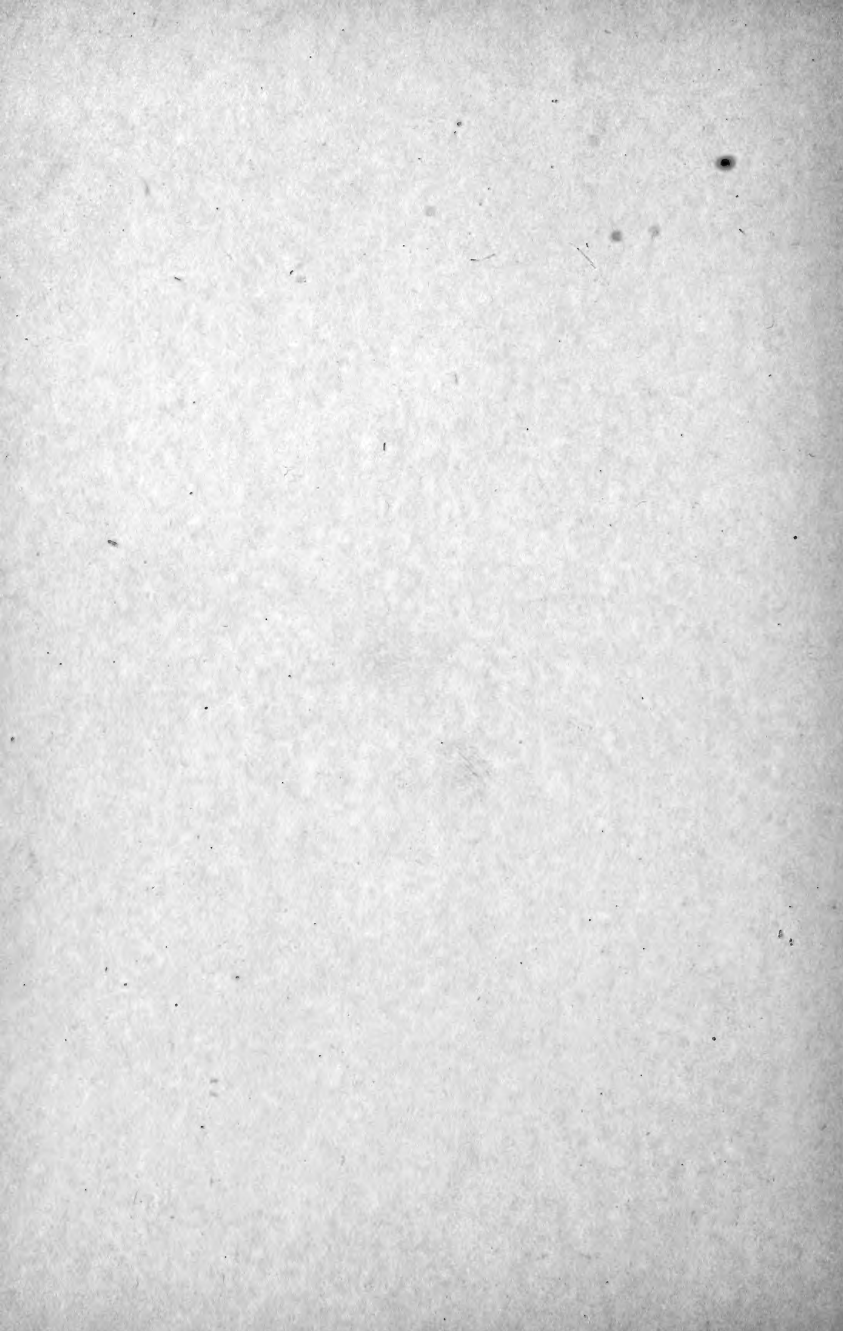
The weaning should be a gradual hardening process so that no sudden change will check or stunt the rapid and vigorous development of the brood. Pay the closest attention to their feeding and comfort at weaning time. Therefore no set time, limit or age can be given for weaning since the breed, the season of the year and their general development would govern in large measure. Six weeks might be a fair age in warmer weather and mild climates while ten weeks might be required in cold seasons and farther north. Again judgment must be exercised for the best results.

About this time if the weather is moderate the brood will begin to show a tendency to desire a roost. A low roosting bench may be given and in a few days the cloth hover may be taken out entirely. Nearly all the half grown chickens will seek the low roosts given them. The roosts may be left out a few days until the colony house shall be occupied if the brooder is otherwise located. The last step in passing from a brood to a grown flock is the putting them out into colony houses upon free range, if possible each sex by itself. Do not put into each house more than twenty-five birds and even less would be better. Ducklings need only a little litter to sit upon but should be kept in a cleanly condition.

SEPARATING THE SEXES.

At or soon after weaning time the young males begin to show signs of sex awakening and begin to develop their combs and wattles. They become important and quarrelsome if kept with the females and cause the latter needless worry which retards development. When apart both sexes do better and are more easily and economically kept, unless intended for breeders.





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